March 2025

EurEau

Position Paper

TFA in Drinking Water Resources

TFA is a very persistent, very mobile member of the PFAS group of chemicals. Due to its numerous emissions pathways, TFA is now ubiquitous in the water cycle and hard to remove by conventional water treatments. The EU should recognise the urgent necessity to stop TFA emissions to the environment as a first step towards addressing this pollution.

Because TFA is an atypical PFAS, the catch-all "PFAS Total" parameter is inadequate for TFA. A specific TFA limit value in drinking water should be set based on health-derived criteria. Where this value would require additional drinking water treatment, these costs should be borne by the polluters.

1. What is Trifluoroacetate (TFA), what are its properties and main uses?

Trifluoroacetate (TFA; CF3COO-) is widely used by the chemical industry and is registered under the REACH Regulation with a tonnage band of 100 to 1000 t per year.

TFA occurs as a transformation product as well as a metabolite of pesticides, pharmaceuticals and halogenated refrigerants (especially R1234yf), as well as a halogenated blowing agent for plastic foams and gases used in anaesthesia. The known refrigerants R134a and R1234yf are emitted from mobile and stationary air conditioning and refrigeration systems. The largest source of emissions of the named refrigerants comes from car air conditioning systems.

TFA is a very persistent and highly mobile substance that can reach all parts of the water cycle and accumulate in various environmental compartments.

2. Main pathways of TFA in the water cycle

The numerous and complex emission pathways of TFA into the environment raise concerns among water suppliers and authorities. TFA has recently been referred to as a "substance of multiple sources" (SMS).

There are close to 10,000 known chemical substances with at least one CF3-moiety in their molecule structure. A fraction of these numerous substances (pesticides, pharmaceuticals, fluorine gases, fluorinated polymers, ...) represent TFA precursors that will be released. When it comes to agrochemicals, around 10% of all pesticides currently on the market contain a C-CF3-moiety. Consequently, it is not surprising that a large number of active

substances must be therefore considered as potential TFA precursors. This recently motivated the European Commission to propose the phase-out of two such pesticides: flufenacet and flutolanil.

Analyses of cattle and pig slurry and of fermentation residues carried out by TZW (DVGW-Technologiezentrum Wasser, Germany) show that these can also be potential TFA sources due to their use as agricultural fertilisers. The contribution of industries and households to the TFA emissions in water bodies via municipal wastewater treatment plants, meanwhile, remains difficult to quantify. It could be assumed that some precursors may end up in the discharge of the municipal wastewater treatment plants, however research suggests they do not constitute a major pathway for TFA releases into the environment.

One important emission pathway is precipitation through rain, snow, fog, etc. into soils and surface waters. The most documented anthropogenic source of TFA is its formation in the atmosphere through photodegradation of certain hydro(chloro)fluorocarbons (HFCs) and hydrofluoroolefins (HFOs). These substances were introduced as substitutes for ozone depleting chlorofluorocarbons (CFCs). HFCs and HFOs are mainly used as refrigerants, gaseous fire extinguishing agents and foam-blowing agents that lead to one of the potential main input pathways in the form of precipitation. Significant other diffuse and ubiquitous inputs of TFA emissions occur through the application of pesticides while industrial operations sometimes cause very high local emission loads.

Ultimately TFA will end up in groundwater and surface water, therefore in almost all of our drinking water resources. TFA has been detected with concentrations ranging from a few ng/L to several µg/L. A recent study by PAN Europe and other NGOs calls for the urgent ban of PFAS pesticides and fluorinated gases, two of the major sources of this ultrashort-chain fluorinated chemical. Data from four EurEau member countries indicates that TFA was detected in the vast majority of drinking water samples. The PAN Europe study found similar results on a smaller scale and detected TFA in mineral water samples as well. An analysis of 29 European surface water and groundwater samples showed that 79% of them recorded an exceedance of 0.5 µg/l, which is the parametric value for PFAS Total in drinking water in the recast Drinking Water Directive.

TFA concentrations in the aquatic environment are expected to increase further for years to come. In Germany, every litre of rainwater now contains on average 335ng/L TFA, a fivefold increase over 20 years. The use of refrigerant substance HFO-1234yf alone was estimated to be responsible for 6900 t/year emissions of TFA in 2020 in the EU, with a potential increase in emissions up to 47,650 t/year by 2050. This could lead to an increase of emissions by several orders of magnitude in the coming years.

3. Regulatory framework for drinking water

Today, neither the World Health Organisation (WHO) nor the European Union or its Member States[1] have set a binding limit value for TFA, hence monitoring is not systematically required. As a result, data availability remains scarce.

Different (proposals of) TFA health-based guidance values exist within Europe ranging from 2.2 to 100µg/L. If TFA becomes classified as a relevant metabolite under the Drinking Water Directive, Member States will have to impose a limit of 0.1µg/L in drinking water.

The justification for this value would be purely administrative, however, with no link to the protection of public health: this figure applies to all relevant metabolites of pesticides and was not defined with any relation to the specific properties of TFA. Moreover, as the previous section showed, pesticides are only one of many sources of TFA emissions to water.

As a consequence of the OECD definition, current EU legislation considers TFA as part of 'PFAS Total'. Directive 2020/2184 (Drinking Water Directive, DWD) sets a parametric value of 0.5µg/L for this 'PFAS Total' parameter, which Member States may use alongside or instead of the sum of 20 specific PFAS, with a parametric value of 0.1µg/L. The sum of 20 PFAS does not include TFA.

Measuring 'PFAS Total' has proved highly challenging. The Commission's *Technical guidelines regarding methods of analysis for monitoring of PFAS in water intended for human consumption* state that there is currently no analytical method that can accurately quantify the 'PFAS Total' parameter. While the guidelines fall back on three possible "proxy" methods, they also state that if the amount resulting from one of these methods is smaller than the TFA concentration (measured separately), then the overall result should be reported as "inconclusive".

4. Expected changes in the near future

The European Commission has tasked the WHO with proposing health-derived guidance values for individual PFAS and groups of PFAS. The WHO may propose such a value for TFA which the Commission will consider when proposing new parametric values for PFAS in the forthcoming DWD revision.

The Commission has also asked the European Food Safety Authority to determine whether TFA should be considered a relevant pesticide metabolite. Due to the arguable links between the DWD and the Pesticides Regulation (EC 1109/2009), drinking water suppliers might have to comply with a precautionary (not health-derived) parametric value of 0.1µg/L for TFA. This would have dramatic consequences for the sector and water consumers (see next section).

[1] With the exception of Denmark, which has set a binding and health-derived limit value for TFA in drinking water at 9µg/L. Some other Member States have set non-binding guidance values.

On the request of the German Federal Agency for Chemicals (BAuA), the European Chemicals agency (ECHA) is also currently examining the re-classification of TFA as acute toxicity 3, skin corrosion 1A, reproductive toxicity 1B, aquatic chronic toxicity 3, persistent, mobile and toxic, and very persistent and very mobile. This potential re-classification would not necessarily lead to a lowering of drinking water guidance values, however.

5. Removing TFA from drinking water

If the limit value of 0.1µg/L for relevant metabolites were to apply to TFA, most drinking water suppliers in Europe could not comply with the DWD using existing treatment steps. Even high-end treatment techniques known today are not suitable for removing TFA from drinking water. Those few techniques that are suitable require a high energy and/or resource input to make them effective. Currently, reverse osmosis is the only available water treatment technique capable of removing short-chain fluorinated substances from drinking water effectively. Initial experiences with ion exchange have left substantial doubt as to its operational effectiveness for removing short-chain fluorinated substances.

While reverse osmosis is effective in removing PFAS and TFA from water intended for human consumption, this method creates a concentrated waste stream of TFA and other pollutants after the treatment. This means that it does not remove PFAS from the water cycle altogether, instead merely retaining it in the concentrate that then requires further treatment to achieve removal. In other words, it shifts the problem to the proper disposal of the fluorinated waste.[2]

In addition, reverse osmosis requires abstracting up to 20% more water from the environment compared to traditional treatment techniques, thereby putting extra pressure on water resources. It is also much more energy-intensive than usual drinking water production methods, and requires re-mineralisation to meet drinking water standards.

Overall, treatment techniques for TFA are technically very challenging, resource-intensive and costly.[3]

6. Actions

All evidence points to further sharp increases of TFA contamination in the environment in all European regions. While concentrations currently remain well below existing guidance values for drinking water in most regions of Europe, the situation will become critical for an increasing number of water suppliers over the next years unless drastic measures are taken. Our rainwater – which is essential to replenishing our water resources – may contain hundreds of nanograms of TFA due to the emission and atmospheric degradation of some fluorinated gases (in particular HFOs) while, at the same time, significant emissions from agriculture through PFAS-containing pesticides increase pollution levels in groundwater.

[2] Riegel, Marcel & Frank Sacher, *Impact Assessment of the Proposed PFAS Limit Value on the German Drinking Water Supply*, TZW/DVGW Forschung, 2021, pp.22-23.
[3] *Ibid.*, pp.1-23.

EurEau urges the EU to take action and:

- Legislate for the immediate cessation of all TFA emissions to the environment and phase out its major precursors, including all PFAS-containing pesticides. This includes uses covered by the Universal PFAS Restriction proposal currently under consideration by ECHA, but also uses that are excluded from its scope, in particular PFAS pesticides and biocides.
- Introduce more detailed area-based monitoring of TFA by the Member States in surface and groundwater in all EU regions to obtain more data.
- Establish regulatory clarity at the EU level and use the forthcoming DWD recast to set a health-derived parametric value for TFA in drinking water, separately from "PFAS Total".
- While the priority should be to prevent and limit TFA emission, the Polluter-Pays Principle should apply to cover the cost of extra treatment of drinking water if this becomes necessary to protect public health.
- Assess the impact of the link between the Pesticides Regulation and the DWD regarding the re-classification of non-relevant pesticide metabolites into relevant ones. The Commission should do this in close coordination with Member States and the water sector. If TFA became a relevant metabolite, many drinking water suppliers might immediately become non-compliant with no immediate remedy.

About EurEau

EurEau represents Europe's drinking and wastewater sector. We encompass 38 national water services associations including public and private operators from 33 countries.

Together we promote the access to safe and reliable water services for Europe's citizens and businesses, the management of water quality and resource efficiency through effective environmental protection.

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